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Hα emission-line stars in molecular clouds★

II. The M 42 region

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ABSTRACT

We present a deep survey of Hα emission-line stars in the M 42 region using wide-field objective prism films. A total of 1699 Hα emission-line stars were identified, of which 1025 were previously unknown, within an area of 5°.5 × 5°.5 centred on the Trapezium Cluster. We present Hα strength estimates, positions, and JHK_s photometry extracted from 2MASS, and comparisons to previous surveys. The spatial distribution of the bulk of the stars follows the molecular cloud as seen in CO and these stars are likely to belong to the very young population of stars associated with the Orion Nebula Cluster. Additionally, there is a scattered population of Hα emission-line stars distributed all over the region surveyed, which may consist partly of foreground stars associated with the young NGC 1980 cluster, as well as some foreground and background dMe or Be stars. The present catalogue adds a large number of candidate low-mass young stars belonging to the Orion population, selected independently of their infrared excess or X-ray emission.

Key words. stars: emission-line, Be – stars: formation – stars: pre-main sequence

1. Introduction

The Orion Molecular Cloud is the nearest giant molecular cloud, a site of intense star formation and one of the most thoroughly studied regions of the sky. The cloud extends for 15 degrees in an elongated shape that can be divided into two subregions, Orion A to the south and Orion B to the north, each having $\sim 10^5\ M_\odot$ of molecular gas (Maddalena et al. 1986).

The well-known OB association Orion OB1 extends through the Orion constellation and constitutes subgroups of different ages and locations, sometimes partially superimposed. Associated with the OB stars (Briceño 2008), the region contains a rich population of intermediate and low-mass young stars. Bally (2008) presents an overview of the young stellar populations, and the morphology and possible formation history of the cloud.

The prominent Orion Nebula, M 42, is an HII region located in the northern part of the Orion A molecular cloud, corresponding to Lynds 1640. To the south, the cloud extends to Lynds 1641, also part of Orion A.

Menten et al. (2007) estimate a distance of 414 pc to M 42, which is the distance we assume here for the entire Orion A cloud.

The M 42 nebula is excited by the massive stars of the Orion Nebula Cluster (ONC), mainly by the Trapezium, a tight cluster of massive young stars. The ONC is one of the youngest and most active sites of star formation of the cloud, studied in detail at many wavelengths (e.g. in the optical by Hillenbrand 1997; and Da Rio et al. 2009; in X-rays by Getman et al. 2005; in the near- and mid-infrared by Megeath et al. 2012). An extensive overview of the ONC can be found in Muench et al. (2008) and O'Dell et al. (2008).

Fewer studies extend the coverage to the wider areas outside of the ONC. Carpenter et al. (2001) used 2MASS to identify over a thousand young stars in Orion A through their variability. They examined a 0°.84 × 6° strip centred on the ONC and found a distribution that correlates with the Hα emission-line stars and the molecular gas. Most of the variability can be explained by cold and hot starspots, by accretion, or by varying extinction.

Davis et al. (2009) imaged Orion A in H_2 2.122 μm in search of molecular hydrogen outflows and their sources, which they classify as mostly protostellar. The *Spitzer* survey from Megeath et al. (2012) covers Orion A and B and classify 2991 pre-main-sequence stars with disks and 488 as likely protostars, based on mid-infrared colours that indicate the presence of a dusty envelope or circumstellar material. A catalogue with five mid-infrared colours is presented. They detect variability in 50% of the young sources.

The powerful radiation field and the expanding HII region of the ONC have cleared away some of the cloud surrounding the cluster, making part of the young stellar content visible at optical wavelengths. Such visible young stars are recognisable through the Hα emission line which is caused by ongoing accretion processes.

Large-scale objective prism surveys focused on the Hα line have for a long time been an important way to identify young stars in clusters and throughout molecular clouds. In Orion, the

★ Full Table 2 is only available in electronic form at the CDS via anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via http://cdsarc.u-strasbg.fr/viz-bin/qcat?J/A+A/570/A30 pioneering work of Haro (1953) identified 255 Hα emission-line stars in an area of 3.5 square degrees around the brightest part of M 42. Parsamian & Chavira (1982) added additional stars to Haro's list, following his nomenclature, and listed a total of 534 stars in a 5 square degree region. Additional information on many of these stars is summarised in the catalogues of Herbig & Kameswara Rao (1972) and Herbig & Bell (1988), which were for years a reference for many of the optically visible young stars in Orion.

Subsequently, a large and systematic Hα emission survey was performed throughout the Orion constellation using the Kiso Schmidt telescope, covering an area of 300 square degrees, resulting in about 1200 emission-line stars detected with limiting magnitude of $V = 17.5$. The results were published in a series of papers, each covering one region in Orion (Wiramihardja et al. 1989; Kogure et al. 1989; Wiramihardja et al. 1991, 1993; Nakano et al. 1995). Their coordinate range in the sky is about $4^{\rm h}\!.8 < \alpha < 6^{\rm h}\!.2$, $-13° < \delta < +7°$ (J2000).

Brand & Wouterloot (1992) present an overview of the low mass star formation in Orion, including a comprehensive list of all Hα emission-line stars compiled from all the surveys known until then, including their own work in the L1641 cloud (Wouterloot & Brand 1992). The catalogue contains 1297 stars in the range $5^{\rm h}\!.45 < \alpha < 5^{\rm h}\!.81$, $-10° < \delta < +02°\!.6$ (J2000). It includes all the Kiso surveys, except for the last two published in 1993 and 1995 (114 stars).

Recently, Szegedi-Elek et al. (2013) performed a survey for Hα emission-line stars in an area of one square degree around the ONC, using slitless grism spectroscopy. They detected 587 stars with emission, of which 99 are new findings.

Another technique used to detect Hα emission is through the use of narrow and wide filters centred on the Hα line. This technique was used by Da Rio et al. (2009). In a $30' \times 30'$ region approximately centred on the ONC they detected 323 stars with a strong line excess exceeding 50 Å in equivalent width and 315 stars with weak Hα excess corresponding to equivalent widths in the 5−50 Å range. As noted by the authors, the uncertainty in the derived Hα emission is difficult to evaluate, and may be affected by various problems, including the non-uniformity of the strong nebular Hα emission. Their survey is mainly focused on the central region of the ONC where we are most affected by the strong nebular background, and hence there is little overlap between our surveys. Finally, one can of course detect Hα emission by obtaining spectra of individual stars. With modern multi-slit spectrographs this is becoming feasible, as for example demonstrated by the kinematic study of Fűrész et al. (2008), who observed 1215 stars in the ONC, of which 1111 stars were confirmed as members. The disadvantage of this method from the point of view of searching for new young stars is that the targets first need to be selected by some criteria, so the search is not unbiased. In the following, we compare our results only with other objective-prism or grism surveys.

In this paper we continue to present the results of a series of large scale searches for Hα emission-line stars using photographic films and the large objective prism at the ESO Schmidt telescope, before it ceased operations in 1998. The first of the series (Reipurth et al. 2004, from now on Paper I) studied the NGC 2264 star forming region, where we detected 357 Hα emission-line stars, of which 244 were new findings. In the present paper we focus on Orion.

The area surveyed here is $5°\!.5 \times 5°\!.5$ on the sky centred on the ONC, covering a wider area than all of the previous surveys except the Kiso survey, but deeper than that one. By going deeper, we are sensitive to lower-mass stars, and also to stars suffering higher extinction.

Table 1. List of Schmidt films.

Date	No.	Exp. time (minutes)	Filter	Seeing (″)
1995 Nov. 24	12093B	120	RG630	1.0
1995 Nov. 27	12103B	15	RG630	1.0
1996 Feb. 13	12175B	120	RG630	0.9
1996 Nov. 20	12852B	40	RG630	0.5
1996 Dec. 13	12896B	150	RG630	0.8
1996 Dec. 14	12898B	150	RG630	0.7
1997 Jan. 06	12935B	40	RG630	0.5
1997 Jan. 11	12952B	90	RG630	0.85
1997 Jan. 31	12972B	90	RG630	0.8

Hα emission in young stars is widely assumed to be triggered by accretion from a circumstellar disk through funnel flows onto the star. Hα emission is thus a measure of a temporary condition, and is therefore expected to be variable, although the timescale of variability is poorly known. An advantage of using Hα emission to identify young stars is that even stars with little circumstellar material, which are thus difficult to identify as young in infrared surveys, can accrete and produce the tell-tale Hα emission. Hα emission-line surveys and infrared surveys therefore to some extent complement each other.

2. Observations

Spectral films (sensitised Kodak 4415) were taken between 1995 and 1997 at the ESO Schmidt telescope at La Silla, equipped with an objective prism that yields a dispersion of 800 Å mm^{-1} at Hα, as already described in detail in Paper I. The RG 630 filter used provides a spectral range from 630 nm to 690 nm, a narrow range centred on the Hα line. Exposure times ranging from 15 min to 150 min allowed the detection of emission in both faint and bright stars. The very central region of M 42, where the nebulosity is too intense, was impossible to examine, even in the shortest exposures. The size of the films (30 cm × 30 cm) corresponds to a field of $5°\!.5 \times 5°\!.5$ on the sky. All exposures were centred on the position α: $5^{\rm h}35^{\rm m}$ δ: $-5°25'$ (J2000). Table 1 lists the films employed in the present study.

3. The survey

The Schmidt films were visually inspected with the use of a binocular microscope in search of emission against the continuum of the stars. About 2360 candidate Hα emission-line objects were initially identified. An Hα strength was assigned to each object, in a range from 1 to 5, following the same procedure used for our NGC 2264 survey (Paper I). The Hα strength is defined so that 1 is weak emission against a strong continuum and 5 is strong emission against a weak or absent continuum. Only the stars identified as unequivocally possessing emission were retained, and emissions identified as coming from HH objects and some galaxies were also removed, which altogether reduced the number of stars in our survey to 1699.

The POSS-II surveys (from 1987/1988 Digitised Sky Survey, DSS) that provide *BRI* images with a plate scale of 1″ pixel^{-1}, were used to obtain initial coordinates for the stars. The images were retrieved in `FITS` format and had astrometric information in their headers. The task `MAKEWCS` from the `IRAF` image reducer package was used on each image to add a coordinate system that

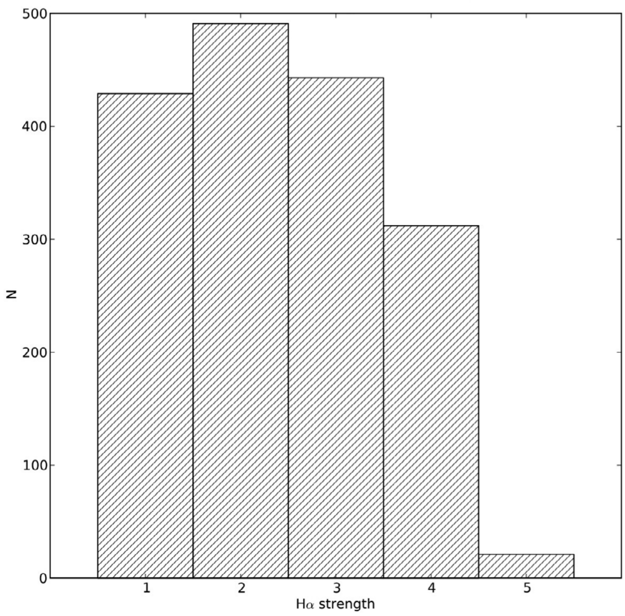

Fig. 1. Distribution of Hα emission strength assigned by eye to the stars. When there was a range of values, the lower one was used.

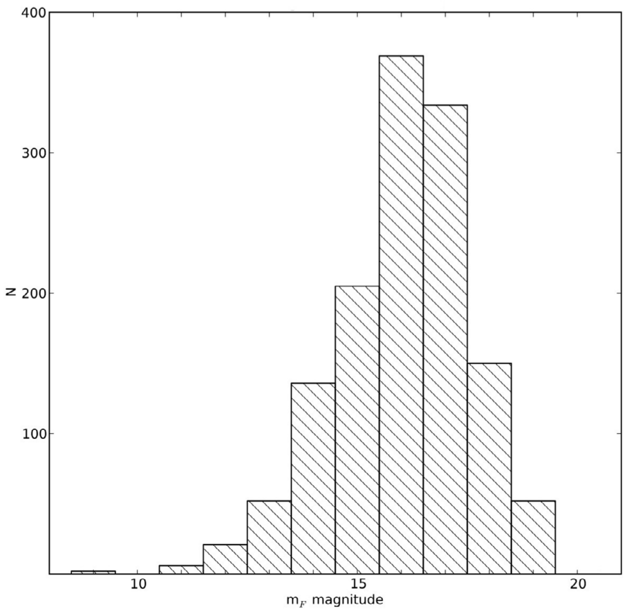

Fig. 2. Brightness distribution of the 1327 Hα emission stars with a m_F magnitude. The limiting magnitude of our survey is about 17−18 mag.

can be understood by IRAF. The IRAF task IMEXAMINE was used to determine the coordinates of each star visually identified in the finding charts. *R* images were used to measure the coordinates for most of the stars, while *I* images were used in regions where the nebulosity is particularly bright at optical wavelengths.

These initial coordinates were searched (within a radius of 2″) among the stars of the 2 Micron All Sky Survey (2MASS) catalogue in order to obtain near infrared JHK_s magnitudes. The 2MASS coordinates have expected uncertainties of 0.″1, better than what we achieved with the DSS images. Therefore, the present survey uses the 2MASS coordinates. In some cases with close pairs the 2MASS listed coordinates were not resolved and coordinates were visually measured from 2MASS *J* frames. Finding charts for the new stars, extracted from the DSS, are presented in Figs. 8−18. Emission-line strengths were estimated by eye on each film separately. Differences in estimates are indicated as hyphenated values, and may represent either intrinsic variability and/or uncertainty in the estimate. Nearly 18% of the stars present such differences. The distribution of Hα emission strength is shown in Fig. 1.

The USNO-B catalogue was used to get blue, red, and infrared photographic magnitudes (m_J, m_F, and m_N) for most of the stars. Blue and red magnitudes were extracted from the GSC-2.2 catalogue for a few additional stars that were only detected in that catalogue. Both catalogues provide optical magnitudes for about 80% of our stars. We also got crossidentifications with the 2MASS catalogue and were able to obtain near-infrared JHK_s magnitudes for all but eight stars.

The brightness distribution of the 1327 Hα emission-line stars with a (red) m_F magnitude is shown in Fig. 2. The limiting magnitude of our survey is about $m_F = 17{-}18$ mag. The peak at 16 mag indicates that the vast majority of the stars detected in our survey are low-mass objects, most likely T Tauri stars. The faintest stars either have higher extinction or they are brown dwarfs.

The spatial distribution of the emission-line stars is shown in Fig. 3. The patches that are empty of stars in the central region are located where the nebulosity is too intense, even in the shortest exposures.

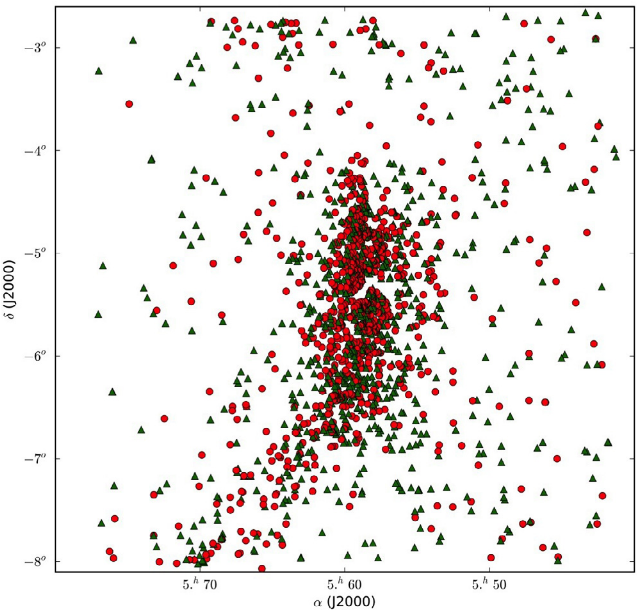

Fig. 3. Spatial distribution of the 1699 Hα emission stars in our M 42 survey. The patches that are empty of stars in the central region are located where the HII region is very intense, complicating the detection of Hα emission-line stars. Stars with an Hα value of 1−2 are plotted with green triangles and 3−5 as red dots. See text for a discussion.

3.1. Comparison with previous surveys

There were 674 stars in our survey that had already been detected in previous objective prism Hα surveys, yielding a total of 1025 new Hα emission-line stars in the Orion region. Of the previously known emission-line stars, 436 are found in the compilation from Brand & Wouterloot (1992), which comprises

Table 2. Hα emission-line stars in M 42.

ESOHα	GCVS	KisoHα[a]	HBC[b]	Haro[c]	PaCh	Other[d]	α(2000)[e]	δ(2000)[e]	Hα[f]	m_J[g]	m_F[g]	m_N[g]	J[h]	H[h]	K_s[h]	Notes[i]
	V731	76-59		4-48	70		05 33 47.71	−04 52 08.5	2	16.05	14.54	13.01	11.64	11.03	10.73	
		76-61		4-99	73		05 33 48.22	−05 13 26.2	3	18.36	16.50	14.90	12.99	12.14	11.71	
857						*	05 33 48.34	−05 22 39.4	1			13.96	12.70	11.99	11.72	
858							05 33 48.51	−07 13 59.3	2	12.63	18.72	15.83	13.81	13.20	12.91	
	V354	76-63		4-300	78		05 33 49.54	−05 36 20.8	2			15.15	12.37	11.32	10.71	
	HX	75-186		4-18	75		05 33 50.27	−04 38 34.2	3	14.61	13.35	12.30	11.21	10.52	10.29	11
859						*	05 33 50.74	−05 00 39.5	2	18.01	16.59	14.91	13.18	12.42	12.12	
		76-64		4-39	77		05 33 51.35	−04 48 22.2	1–2	16.26	14.68	13.64	12.48	11.61	11.27	
	HY	76-66		4-159	81		05 33 52.36	−05 41 50.2	1	15.60	14.52	12.82	11.72	10.90	10.56	
860							05 33 52.62	−04 57 51.0	3	18.67	16.91	15.43	13.37	12.74	12.46	
861							05 33 53.38	−07 14 11.6	2	17.58	16.41	13.81	12.88	12.30	12.06	2, 8

Notes. The full table with all the 1699 Hα emission-line stars is available at the CDS. A few lines are reproduced here only for guidance regarding format and content. [(a)] Kiso Hα catalogue from Wiramihardja et al. (1993). [(b)] Herbig & Bell (1988) catalogue. [(c)] Haro (1953) catalogue: Haro 4-1 to 4-255, Parsamian & Chavira (1982): Haro 4-256 to 4-495, Haro & Moreno (1953): Haro 5-1 to 5-98. [(d)] An asterisk means a star also listed in Szegedi-Elek et al. (2013). [(e)] Positions extracted from the 2MASS All-Sky Catalog. [(f)] The Hα strength is defined so 1 is weak emission against a strong continuum and 5 is strong emission against a weak or invisible continuum. Hyphenated values may represent either variability and/or uncertainty in the estimate. A "+" indicates resolved spectra but unresolved DSS image. [(g)] The magnitudes m_J, m_F, and m_N are from the blue (IIIaJ emulsion), red (IIIaF emulsion), and infrared (IV-N emulsion) digitised sky surveys extracted from USNO-B catalogue or from GSC 2.2. [(h)] JHK_s magnitudes extracted from the 2MASS All-Sky Catalog. [(i)] Notes to individual stars.

most of the work done until then in surveying the Orion region for Hα emission-line stars. The star Strom 6 appears in Brand & Wouterloot (1992) but is designated as L1641 N. In addition, 238 stars were found to be in common with the recent survey of Szegedi-Elek et al. (2013). Since the stars of Szegedi-Elek et al. were not given an identifier and their survey was done simultaneously with our present survey, we have retained our ESO-Hα numbers for those stars that we have in common.

The Herbig & Bell (1988) catalogue (HBC) has 126 stars inside our field, of which we detected 55 (44%). The HBC catalogue was compiled from stars observed with different techniques and at different epochs. At least a dozen HBC stars are located in the brightest M 42 area, where our films are overexposed.

Haro's catalogue (Haro 1953; Parsamian & Chavira 1982) has 530 stars in our field, of which 359 were detected by us (68%). Their coordinates are in some cases rather uncertain, and this plus variability in the line emission must account for the 32% of stars not detected by us.

Among the 471 stars from the Kiso Hα catalogue of Wiramihardja et al. (1993) that lie inside our field, 314 were also detected by us, a fraction of about 67%. The Kiso catalogue was constructed in a more uniform way, similar to our survey, but the ratio of stars in common is still low. Our survey is much deeper than Kiso's; our long exposures reach 150 min while Kiso's maximum exposures are 90 min, and in the same area surveyed they detected a quarter of the number of emission-line stars detected in our survey. In general the Hα emission strengths assigned by eye (with the same scale) in both surveys agree very well, but it is noteworthy that most of the stars in common have larger emission strengths, peaking at 3. The undetected Kiso objects were all re-examined on our films; some were located in the overexposed areas, while others were classified by us as possible emitters, but were not included in our final table. About 60% of the undetected Kiso objects certainly show no emission at our resolution.

3.2. Description of the table

A table with the Hα emission stars in M 42 was built using the same criteria as the NGC 2264 survey (Paper I). Some representative lines are listed in Table 2. The full table is available in electronic form at the CDS. The first columns are: the

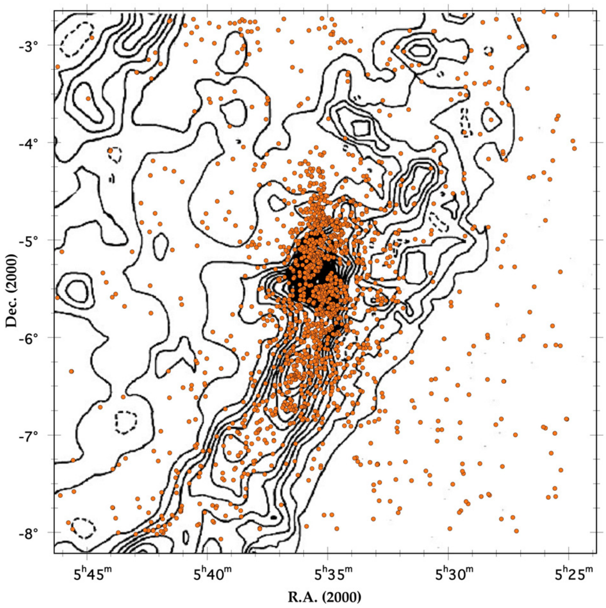

Fig. 4. Distribution of the Hα emission stars (orange dots) overplotted on a CO map contour from Maddalena et al. (1986).

ESO Hα identification number, assigned only to the stars not detected previously, the variable name or number from General catalogue of variable stars (Kukarkin 1985), followed by the identification numbers of the Hα emission surveys from Wiramihardja et al. (1993), Herbig & Bell (1988), Haro (1953), Parsamian & Chavira (1982), and other possible names. The coordinates (J2000) are given in the next columns, followed by the Hα emission strength and the magnitudes obtained in the USNO-B catalogue (m_J, m_F, and m_N) and in 2MASS (JHK_s). The last column provides comments on individual objects. Finding charts for individual stars, often located in crowded regions or as components in close binaries, are presented in Figs. 8–18.

3.3. Spatial distribution and relation to CO clouds

The main concentration of Hα-emitting stars corresponds very well to the distribution of the gas in the Orion A Cloud, as shown in Fig. 4 in a comparison with a CO map from

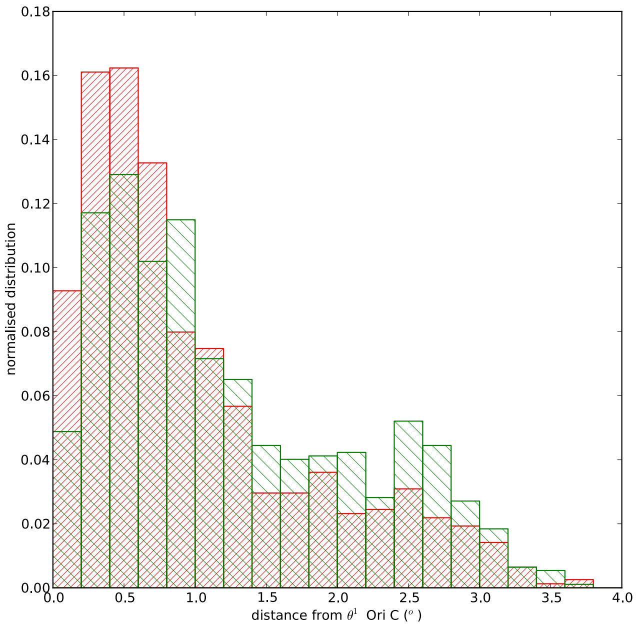

Fig. 5. Distribution of stellar density with increasing distance to Θ Ori. A difference in distribution between stronger-lined stars (red, dense hatch) and weaker-lined stars (green, sparse hatch) is apparent, with the former more clustered around the Trapezium and a wider distribution of the latter.

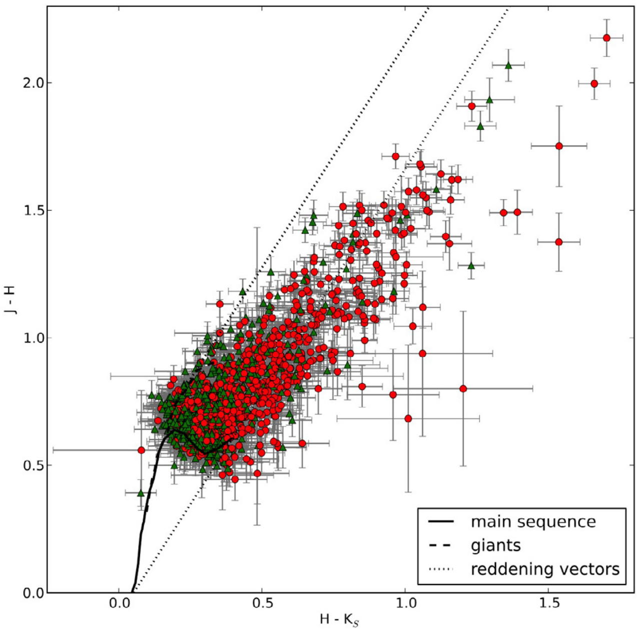

Fig. 6. Near-infrared colour−colour diagram based on 2MASS data showing all the Hα emitters in M 42 with 2MASS detections in all the three bands (JHK_s), except upper limits. Main-sequence and giant loci from Bessell & Brett (1988), corrected to the 2MASS photometric system (Carpenter et al. 2001) and the extinction law from Rieke & Lebofsky (1985), are represented in the figure. Symbols as defined in Fig. 3.

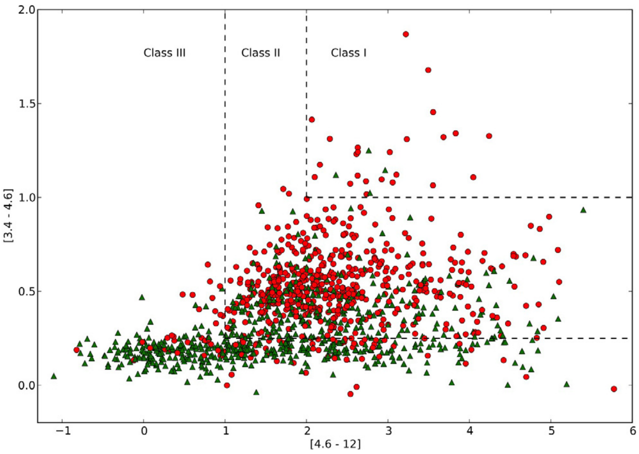

Fig. 7. Distribution in a *WISE* two-colour diagram, separating stronger-lined stars (red dots) from weaker-lined stars (green triangles). The dashed lines separate Class I, II, and III sources, see discussion in Koenig et al. (2012)

Maddalena et al. (1986). The region with the largest number of stars matches the area with strongest CO emission, and the stellar density continues to trace the south-eastern L1641 dark cloud. The vast majority of these stars are likely to represent young T Tauri stars with ages approximately similar to the age of the ONC.

Additionally, there is an almost uniform distribution of stars all over the 30 sq. degree area of our survey. This population may have a more complex composition. First, some of the stars may originate in the ONC, and have been scattered away as a result of N-body interactions in the cluster. Second, there is a slightly higher density of Hα emitters to the west of the cloud, where the extinction is quite a bit lower than to the east. This might indicate that some of the stars could be background stars, for example distant Be stars. Third, and perhaps most important, it is known that there are several generations and populations of young stars in the general direction of the ONC (e.g. Blaauw 1964; Warren & Hesser 1978; and Gomez & Lada 1998). Most recently, Bouy et al. (2014) have argued that there is a rich population in front of the Orion A cloud, centred on and probably originating in the little-studied cluster NGC 1980 just south of the ONC. At an age of ∼4–5 Myr, this foreground cluster would still have many low-mass members with Hα emission. We would expect a younger population to have generally stronger emission, whereas an older population would have fewer stars with strong emission. We have examined this, and in Fig. 5 the stellar density of the two groups is plotted as a function of distance to the centre of the ONC. It is evident that the stronger-line stars (Hα-strength 3, 4, 5) are indeed more concentrated towards the centre of the ONC, whereas the weaker-line stars (Hα-strength 1, 2) are more distributed. This supports the idea of Bouy et al. (2014) that we are seeing the mixture of two populations of young stars, one related to the ONC and another to the slightly older NGC 1980 region. Additional interlopers from, for example, the NGC 2024 and σ Ori regions may be present as well.

It thus appears that the Hα emission stars found across our field represent two distinct groups, one related to the young population of ONC stars, and another group more uniformly spread across the field with a mixed origin, some coming from the foreground NGC 1980 cluster and others representing scattered ONC stars or background Be stars.

3.4. Near-infrared properties

The Hα emission stars of our survey that are detected in all three bands of the 2MASS near-infrared catalogue are plotted in a colour−colour diagram $(J-H)$ vs. $(H-K_s)$ in Fig. 6. Also plotted are the locations of main-sequence and giant stars from

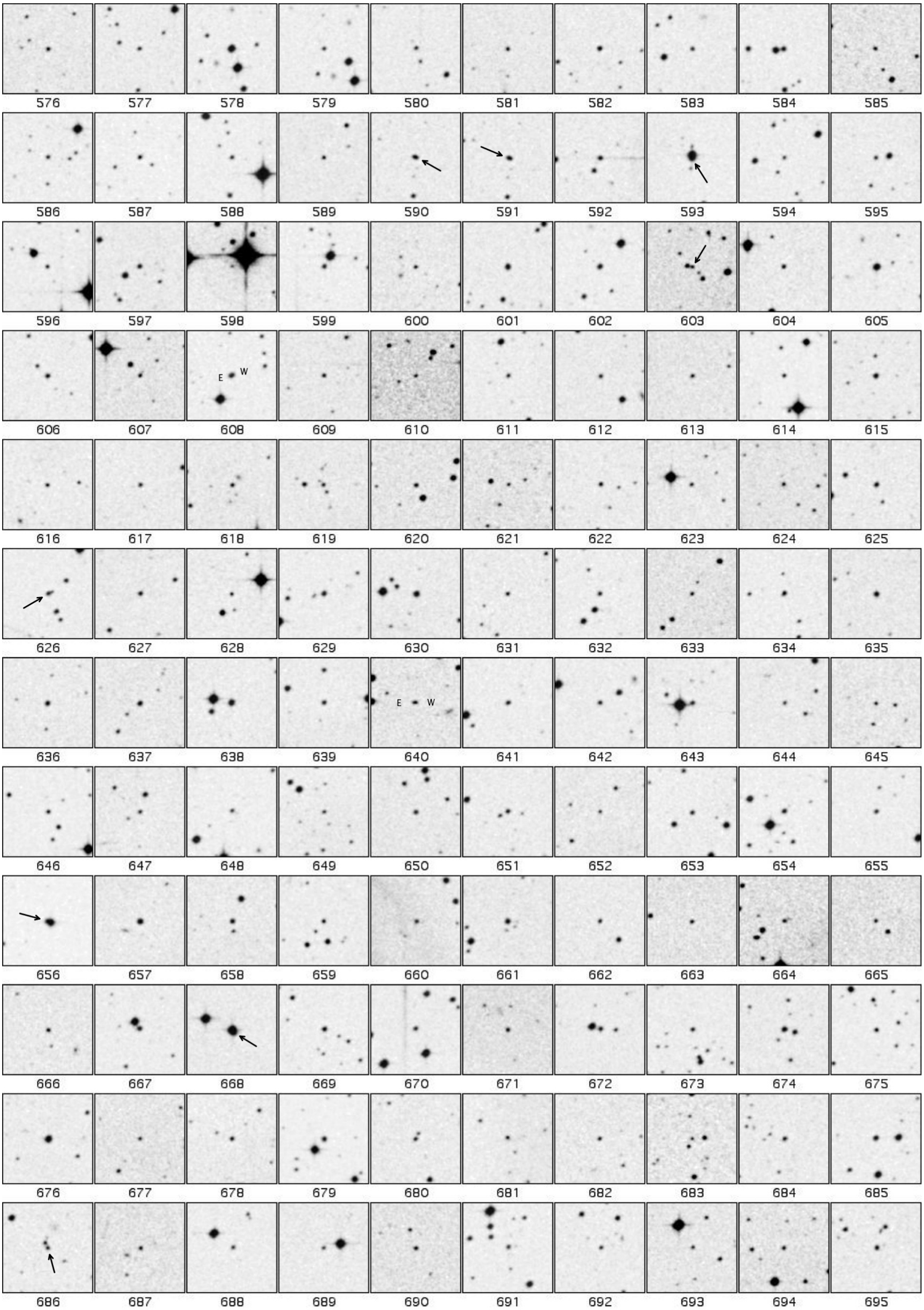

Fig. 8. Finding charts, 90″ to a side. North is up and east to the left.

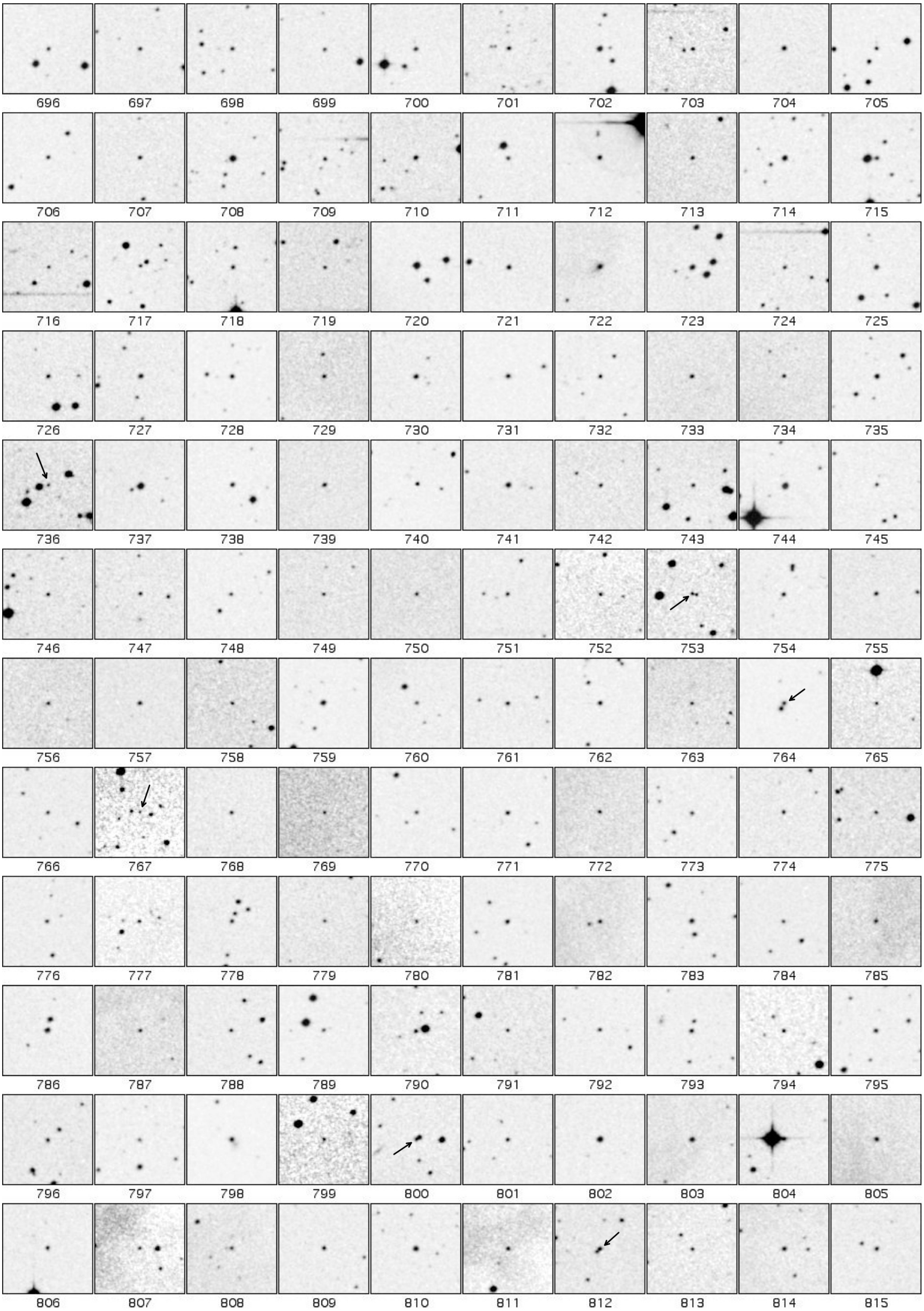

Fig. 9. Finding charts, 90″ to a side. North is up and east to the left.

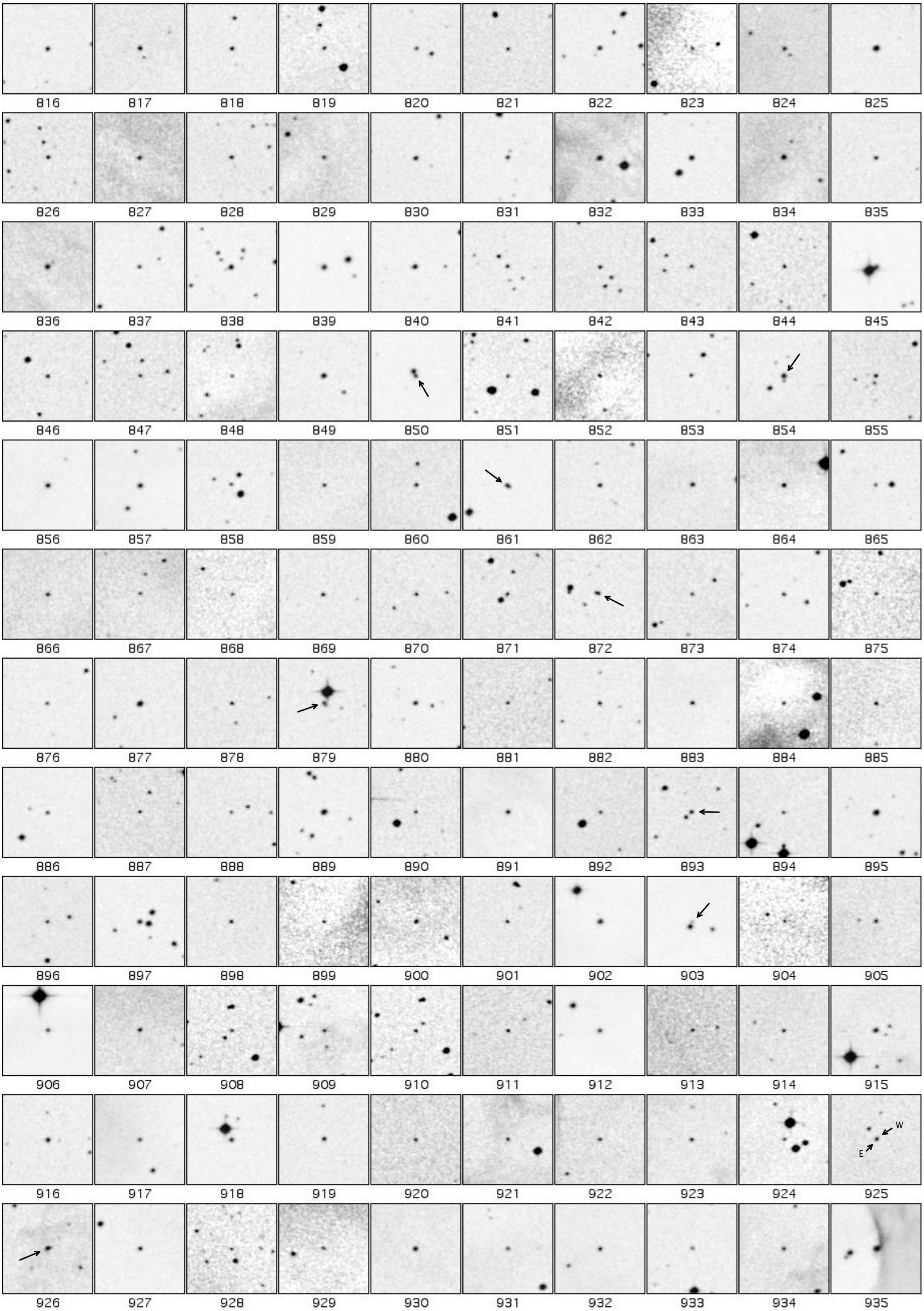

Fig. 10. Finding charts, 90″ to a side. North is up and east to the left.

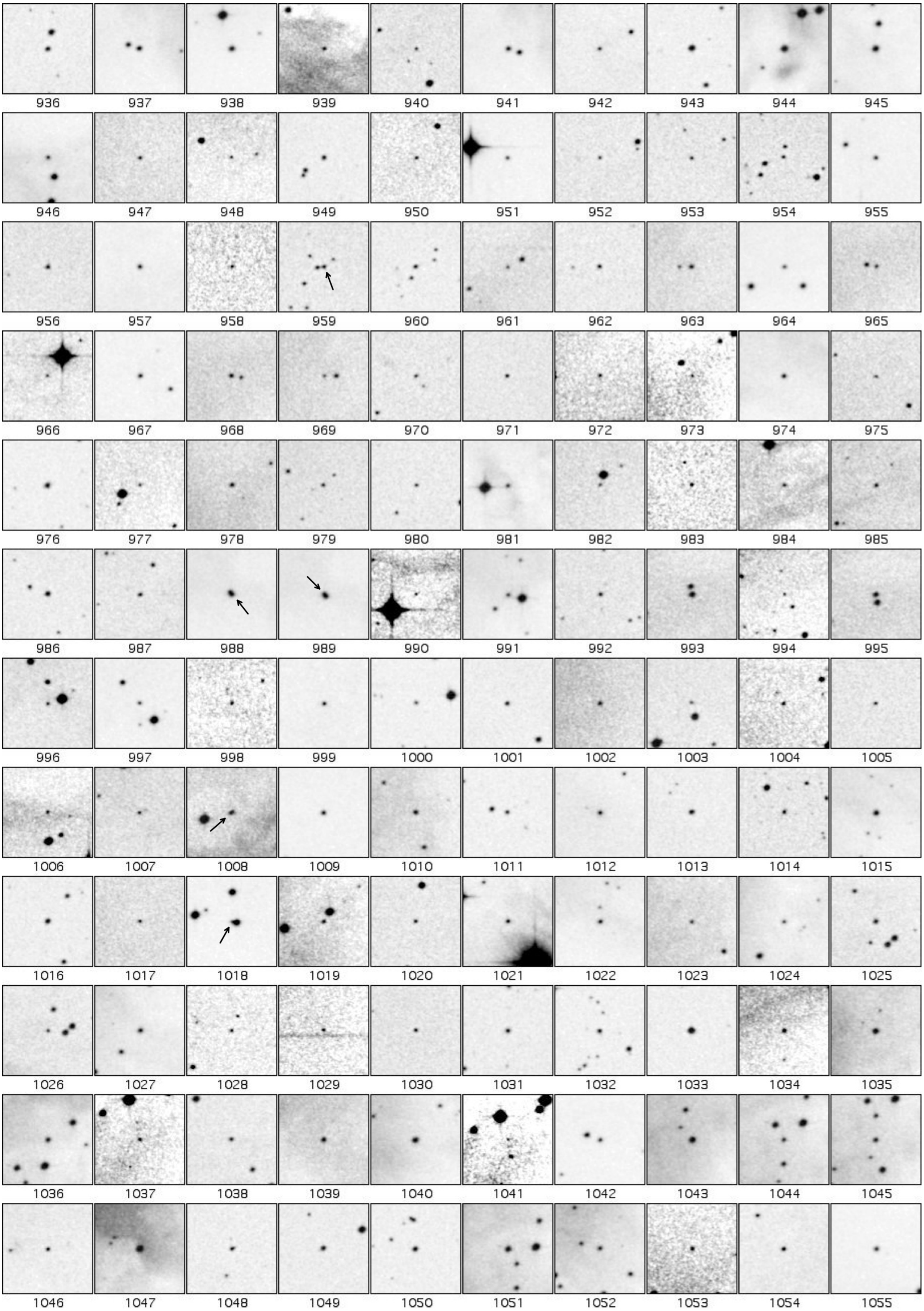

Fig. 11. Finding charts, 90″ to a side. North is up and east to the left.

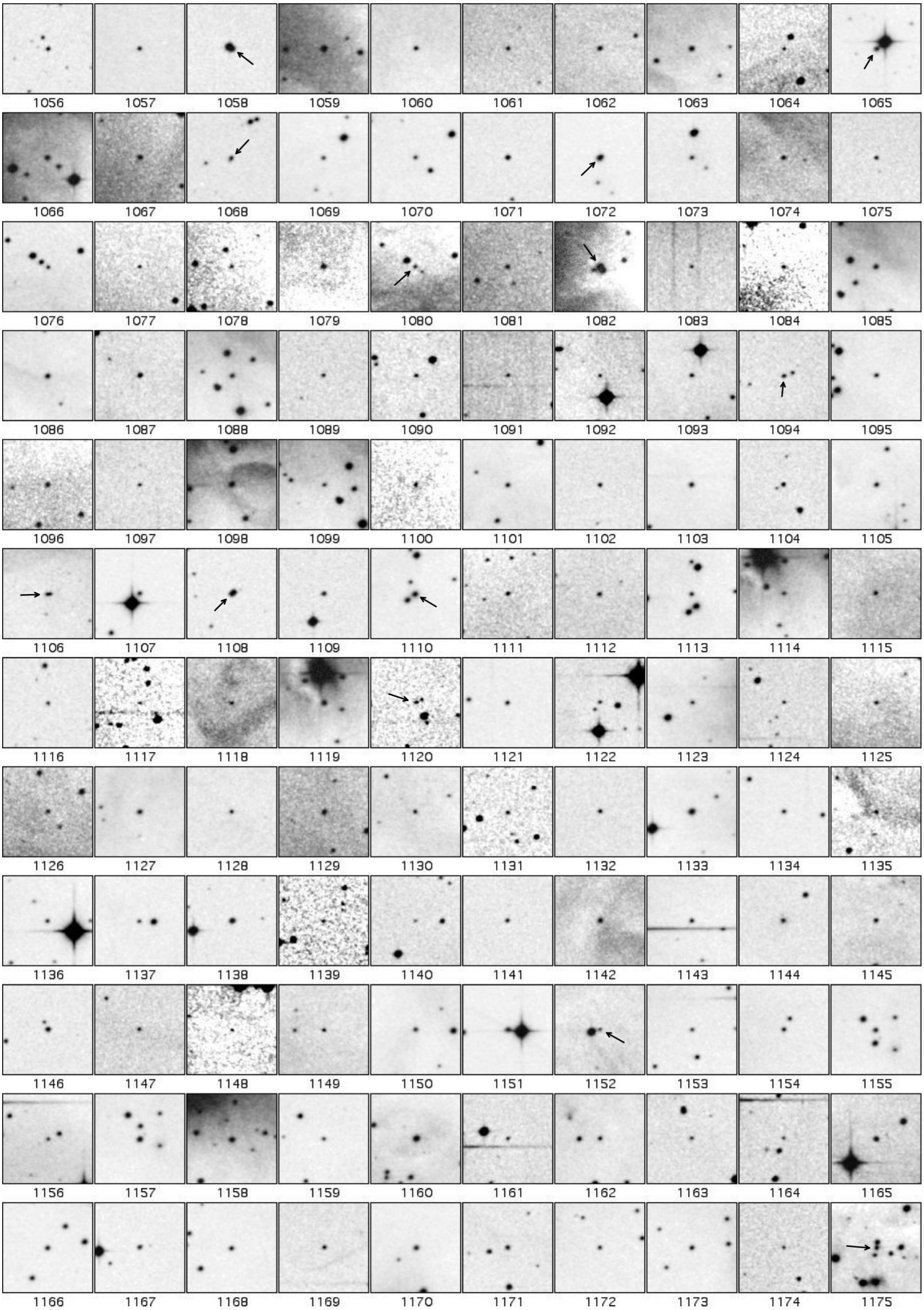

Fig. 12. Finding charts, 90″ to a side. North is up and east to the left.

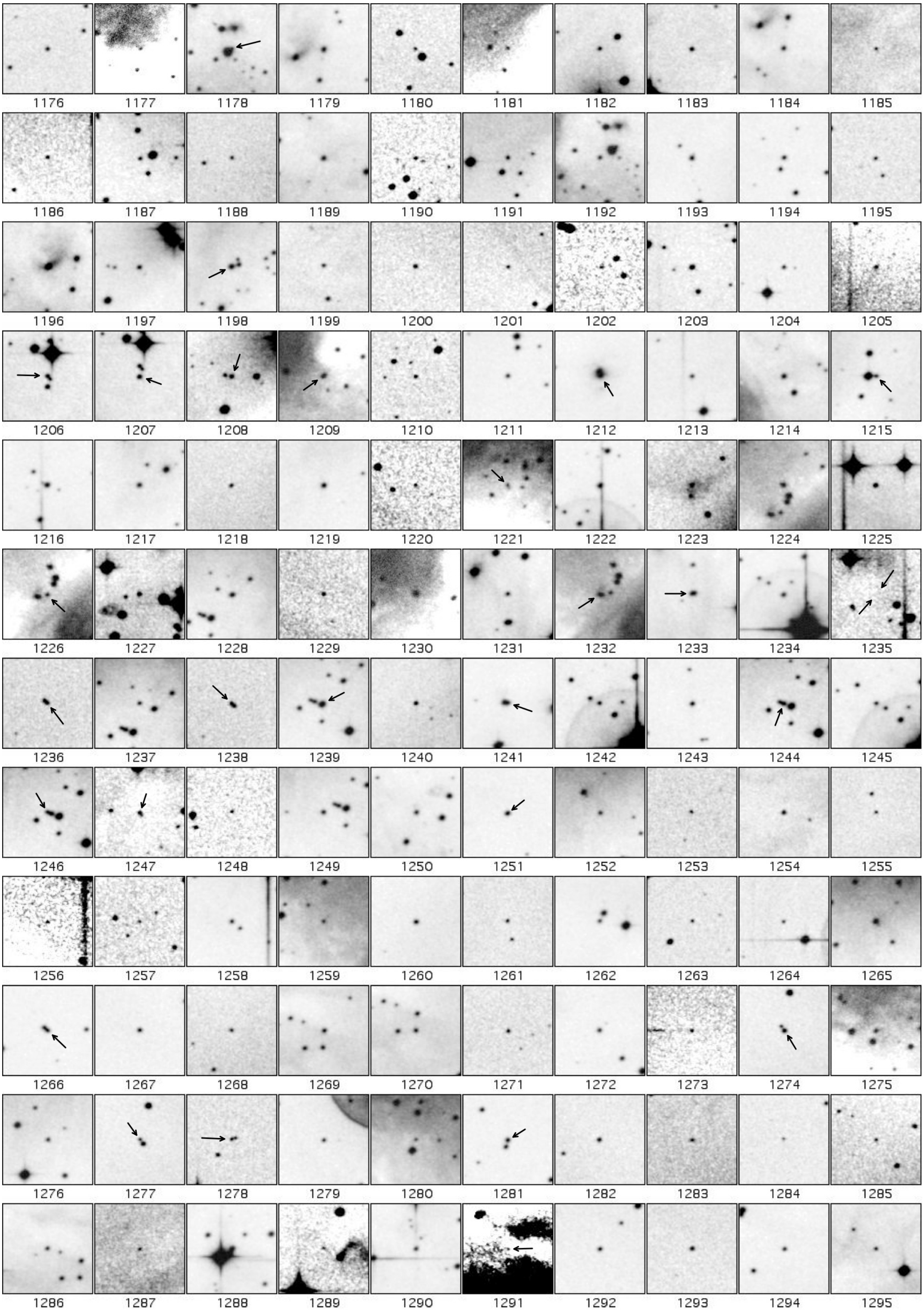

Fig. 13. Finding charts, 90″ to a side. North is up and east to the left.

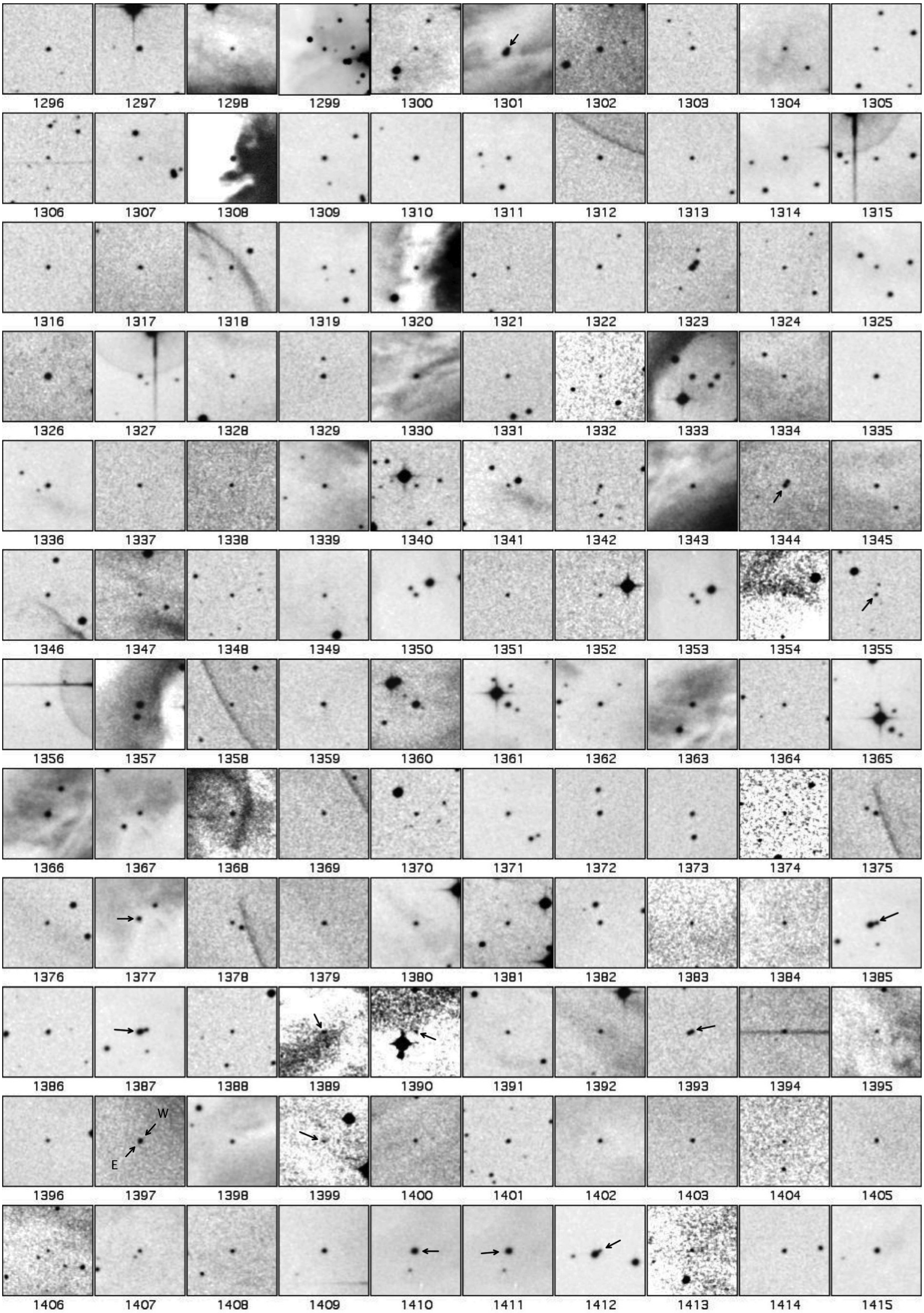

Fig. 14. Finding charts, 90″ to a side. North is up and east to the left.

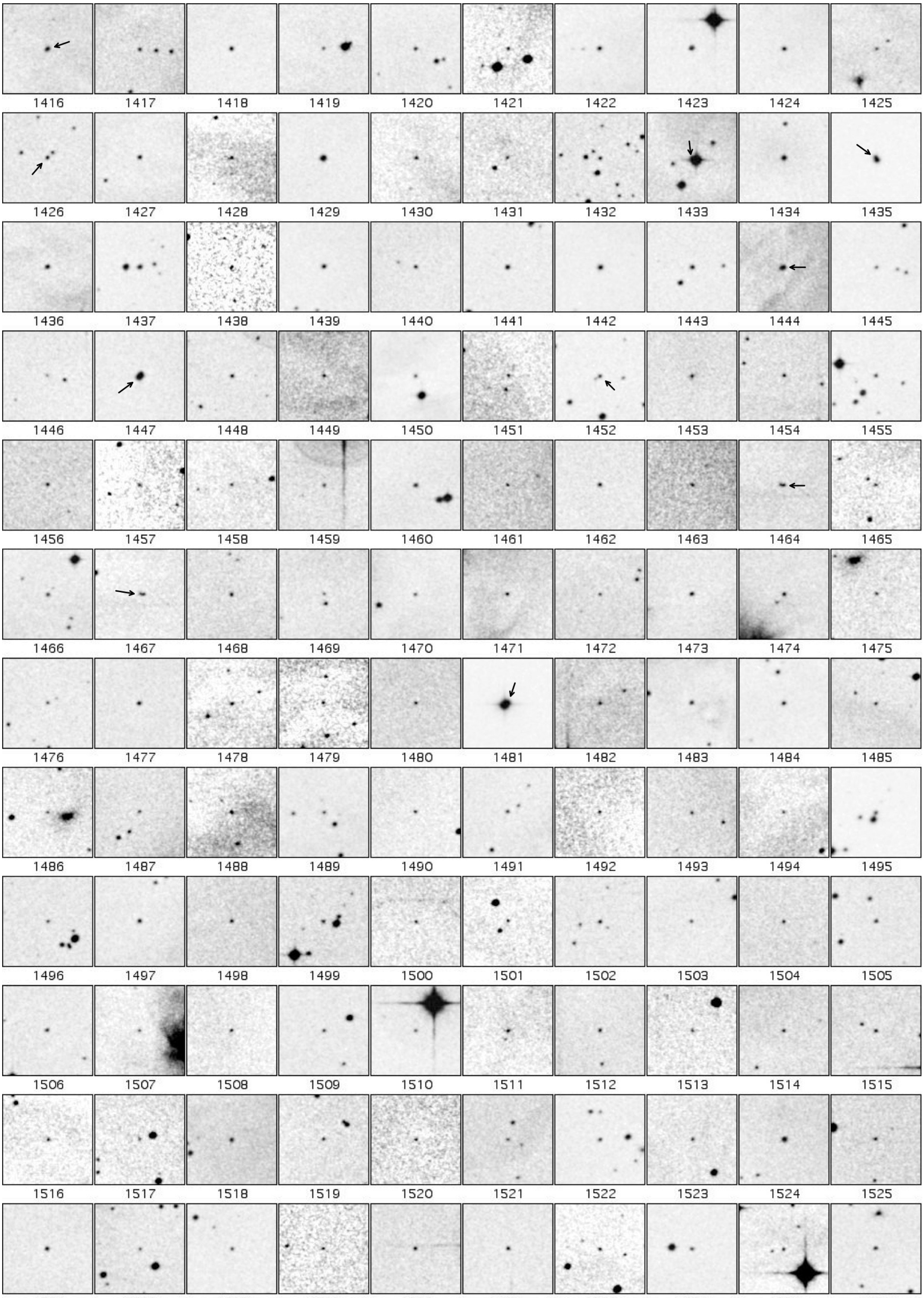

Fig. 15. Finding charts, 90″ to a side. North is up and east to the left.

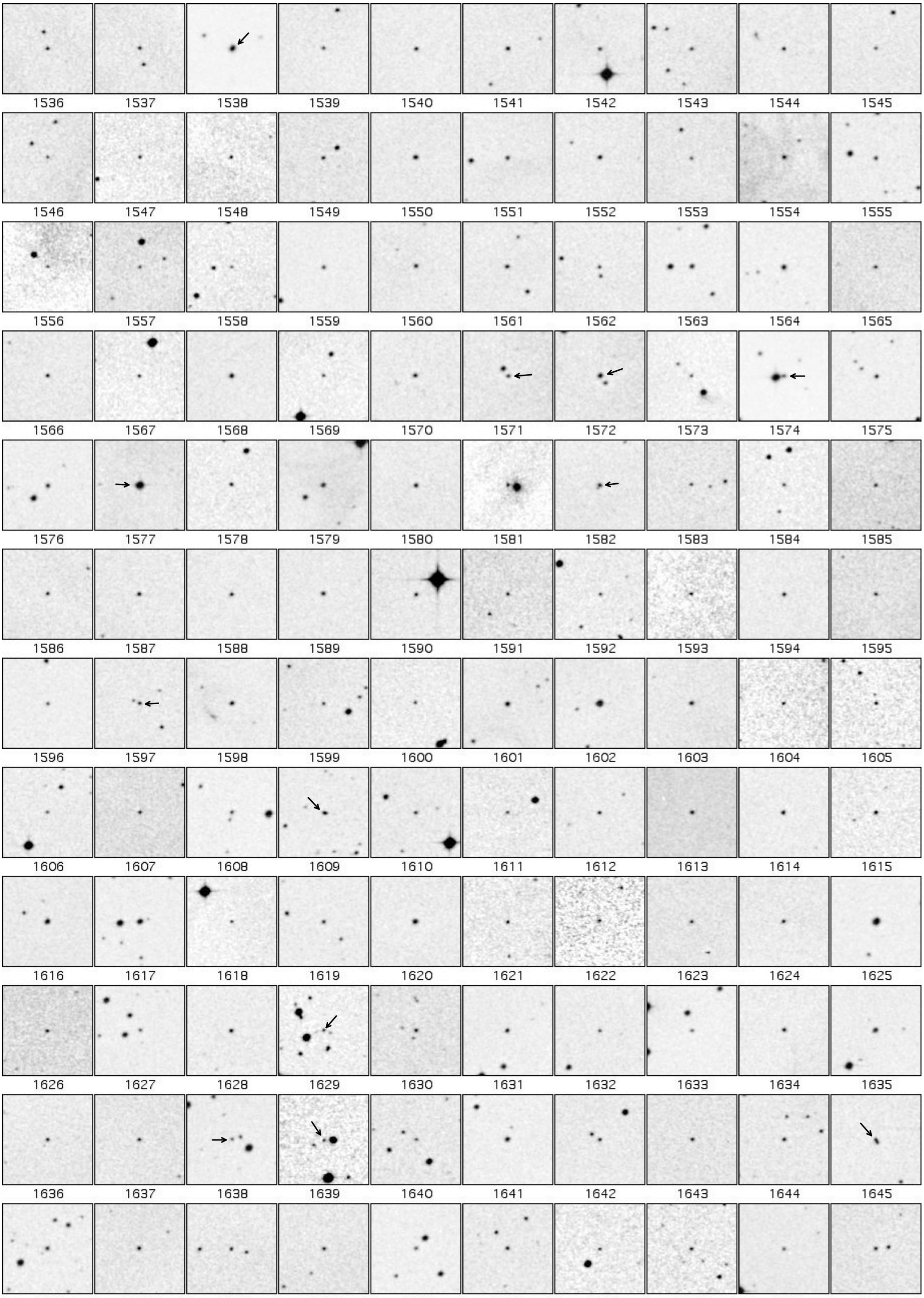

Fig. 16. Finding charts, 90″ to a side. North is up and east to the left.

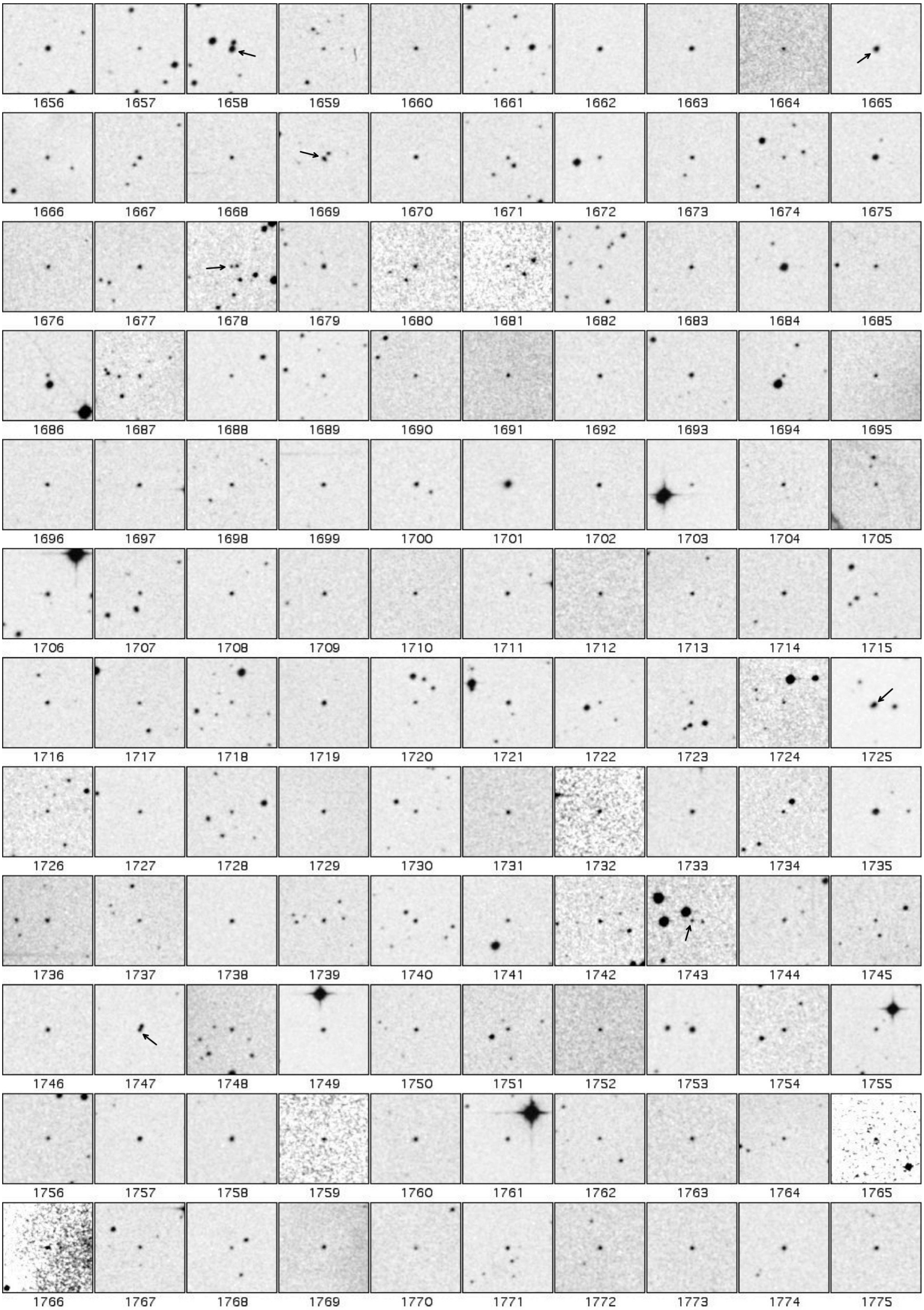

Fig. 17. Finding charts, 90″ to a side. North is up and east to the left.

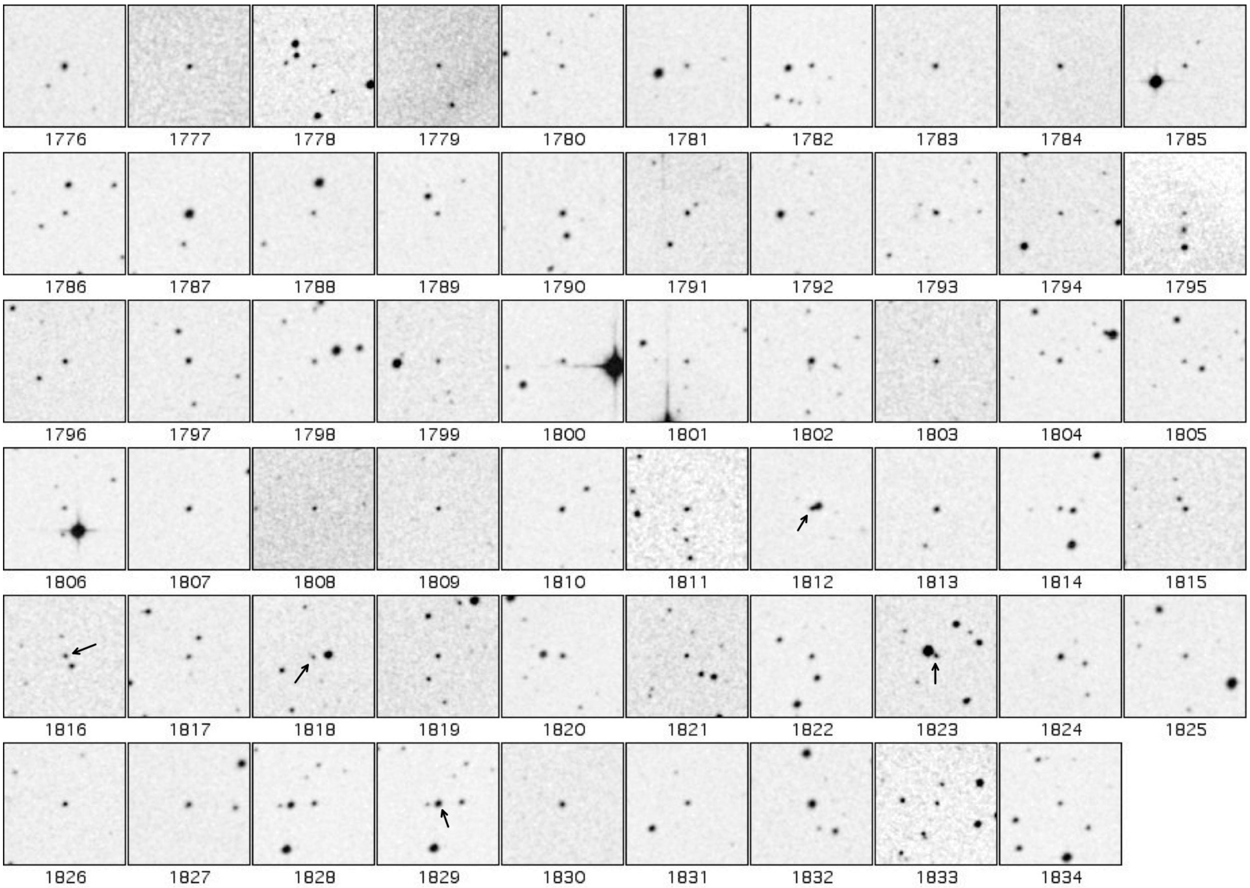

Fig. 18. Finding charts, 90″ to a side. North is up and east to the left.

Bessell & Brett (1988) corrected to the 2MASS photometric system (Carpenter et al. 2001), with interstellar reddening vectors from Rieke & Lebofsky (1985).

Of 1664 stars with valid JHK_s magnitudes, 261 ± 51 have infrared excess, one indication of the presence of circumstellar material. The uncertainties in the 2MASS magnitudes are on average 0.04 mag and can raise or lower the number of infrared-excess stars by about a quarter.

The fraction of Hα emitting stars with infrared excess is only $\sim 16 \pm 4\%$. In our survey of NGC 2264 (Paper I) performed with the same equipment, we found that $23 \pm 8\%$ of the Hα emitters show an infrared excess, which is similar within the cited errors. There can be several reasons that only a relatively small fraction of Hα emitters have infrared excess. First, many weak-line T Tauri stars have little circumstellar material. Second, not all Hα emitting stars are necessarily young, for example dMe stars and Be stars will have Hα emission, but no infrared excess. Third, although the population of stars from the foreground cluster NGC 1980 is young, at an age of 4–5 Myr there will be many fewer classical T Tauri stars than among the ONC population. Fourth, even young stars with little circumstellar material can from time to time accrete and thus temporarily produce Hα emission.

A small number of stars (less than 2%) are located in the so-called forbidden region to the left of the main-sequence locus and the reddening vectors, but all of them are faint and/or located in nebulous regions, suggesting that their 2MASS uncertainties are underestimated.

In Fig. 7 the distribution of the stronger-lined stars (Hα-strength 3, 4, 5) and the weaker-lined stars (Hα-strength 1, 2) is plotted in a *WISE* two-colour diagram used to classify young stars into Classes I, II, and III based on infrared excess as an indicator for the presence of circumstellar material (e.g. Koenig et al. 2012). Of the few stars that fall in the Class I category almost all have strong Hα emission. The Class II category is also dominated by stars with stronger emission, although a sizeable number of weaker-lined stars are also in this category. The Class III category is strongly dominated by stars with weak line-emission. Since Hα-emission is mainly an indicator for ongoing accretion, these results follow the intuition that stars with more circumstellar material are more likely to be actively accreting.

4. Conclusions

We have observed the central Orion region in a deep wide-field survey for Hα emission-line stars, detecting 1699 stars with emission, of which 1025 were previously not known to show Hα emission. The stars fall into two groups, one that contains most of the stars and is distributed along the L1641 cloud, and another that is more or less uniformly distributed. A detailed photometric and spectroscopic follow-up study is required to more precisely identify which stars are likely to be members of the young ONC population, or of the slightly less young foreground NGC 1980 population, or are general foreground or background stars.

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